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application be reexamined and reconsidered in view of the following remarks.

Applicants' Pending Claims

Applicants' claims 107 and 108 call for a γ -alumina support material which, prior to adding any catalytic material thereto, has been treated in accordance with the novel procedure of the present invention such that the γ -alumina support material itself has improved attrition resistance. Applicants' claims 100-106 are similar to claims 107 and 108 but specifically require that the γ -alumina support material have improved attrition resistance for Fischer-Tropsch hydrocarbon synthesis. Applicants' claims 89-100 call for cobalt-on- γ -alumina catalyst produced by depositing cobalt on the inventive, more attrition resistant γ -alumina material.

The novel γ -alumina support material called for in Applicants' claims 101 and 107 is produced by treating particulate γ -alumina material with an acidic aqueous solution comprising water and nitric acid, such solution having a pH of not more than 5. Following the acidic solution treatment, the particulate γ -alumina material is then calcined at a temperature (preferably about 350°C) such that at least most of the particulate γ -alumina material remains in γ -alumina form. Applicants' claims make clear that the attrition resistance improvement of claims 101-107 is made to the particulate γ -alumina material itself and does not involve or require the addition of any type of hard outer coating. The

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improvement to the particulate γ -alumina material also does not involve or result from any type of catalyst deposition procedure. Nor does the improvement to the particulate γ -alumina material involve or require the addition of any particular type of catalytic material. Rather, claims 101 and 107 specifically provide that the improved particulate γ -alumina material is formed prior to adding any catalytic material, of any kind, thereto.

Applicants' claims 104 and 108 depend from claims 101 and 107, respectively, and require that the acidic aqueous solution must consist essentially of water and nitric acid and must have a pH in the range of from about 3 to about 1. Applicants' claim 106 depends from claim 101 and requires that the inventive γ -alumina material be formed from boehmite which is calcined prior to the acidic solution treatment at a temperature in the range of from about 350 to about 700°C. Thus, claims 106 requires two calcination procedures, the first being conducted prior to the acidic solution treatment and the second being conducted after the acidic solution treatment but prior to the deposition of any catalytic material.

As indicated above, Applicants' claims 89-100 call for a novel cobalt-on- γ -alumina catalyst comprising the inventive, improved particulate γ -alumina material.

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The Examiner's Rejections

In the final Office Action mailed August 23, 2002, the Examiner rejected Applicants' claims 89-108 under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious in view of USPN 4,493,905, issued to Beuther, et al. The Examiner also rejected claims 89-108 under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious in view of USPN 5,037,791, issued to Comolli, et al.

Beuther, et al. and Comolli, et al. Neither Disclose Nor Suggest the Inventive γ -Alumina Support Material or the Inventive Cobalt-on- γ -Alumina Catalyst Called for in Applicants' Claims

Beuther, et al disclose a promoted cobalt-on-alumina catalyst for synthesis gas conversion to produce diesel fuel. Beuther, et al. simply state, in passing, that the catalyst supposedly has high attrition resistance. However, Beuther, et al. never quantify or even attempt to determine, show, or prove any type of attrition resistance improvement. Nor do Beuther, et al. provide any explanation or parameters or procedures which would assist those skilled in the art in understanding why or how an attrition resistance improvement could be achieved.

A thorough reading of the Beuther, et al. patent reveals that Beuther, et al. disclose only a catalyst preparation procedure which must include the steps of (a) contacting finely divided

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alumina with an aqueous solution of a cobalt salt, (b) drying the resulting material, and then (c) contacting the dried product with a nonaqueous, organic impregnation solution of ruthenium and a Group IIIB or IVB metal. Beuther, et al. neither disclose nor suggest any type of acidic aqueous solution treatment and/or recalcining steps prior to contacting the finely divided alumina with the aqueous cobalt salt solution. Nor do Beuther, et al. provide any information, requirements, or suggestions concerning the concentration, pH, or other properties of the cobalt salt solution. Moreover, rather than suggesting any type of acidic solution treatment, Beuther, et al. expressly require that the nonaqueous, organic impregnation solution employed in the Beuther, et al. process be non-acidic. For example, Beuther et al. state at Col. 3, lines 23-27 that:

In general, any metal salt which is soluble in the organic solvent of the present invention and will not introduce any significant acidity or have a significant poisonous effect. . .on the catalyst can be utilized.

Moreover, Beuther et al. state at Col. 3, lines 29-33 that: "The nonaqueous or organic solvent of the present invention is a non-acidic liquid. . ."

Similar to the Beuther, et al. patent, Comolli, et al. neither disclose nor suggest any procedure or process whereby the attrition resistance of γ -alumina itself is improved. Rather, Comolli, et al. teach only a carbon-coated catalyst formed by depositing a porous carbon layer on a support material. The carbon layer must

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be of sufficient thickness to comprise from 5 to 40 weight percent of the catalyst. (See abstract.) In addition, in further contrast to the requirement of Applicants' claims that Applicants' acidic solution treatment be performed prior to adding any catalytic material, the carbon layer of the Comolli, et al. catalyst constitutes a catalytic material which is activated by partial oxidation, pyrolysis, or reduction. (*Id.*)

Thus, given the actual disclosures and teachings of Beuther, et al. and Comolli, et al., Applicants are unable to determine the bases for the Examiner's rejections under 35 U.S.C. §§ 102(b) and/or 103(a). It appears that the Examiner is arguing that all cobalt-on-alumina catalysts purported to somehow have "high attrition resistance" are, by law, effectively the same. However, this is clearly not the case and cannot conceivably constitute a proper basis for rejecting product-by-process claims.

As seen in Applicants' claims and as demonstrated in the specification of the application, Applicants' inventive γ -alumina support material and inventive cobalt-on- γ -alumina catalyst unexpectedly have various beneficial characteristics and properties which are neither found in nor suggested by the catalysts and procedures taught by Beuther, et al. and Comolli, et al. Moreover, Applicants have clearly demonstrated that these unexpected beneficial characteristics and properties are the result of the acidic solution treatment process used by Applicants to form and

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improve Applicants' inventive particulate γ -alumina support material. As shown above, neither Beuther, et al. nor Comolli, et al. disclose or suggest this process. Moreover, Beuther, et al. teaches away from the use of solutions which introduce any significant acidity.

In complete contrast to the actual teachings and requirements of Beuther, et al. and Comolli, et al., the attrition resistance improvement provided by Applicants' invention (a) involves a direct change in the characteristics and properties of the γ -alumina material itself, (b) does not involve or require any type of hard coating on the exterior of the γ -alumina material, (c) does not involve or result from the deposition of any type of catalytic metal or other catalytic material, (d) exists in the γ -alumina support material prior to or without the deposition of any catalytic material, and (e) is in no way limited in claims 101-108 to use in cobalt catalysts.

Conclusion

In view of the above, Applicants respectfully submit that Applicants' claims 89-108 are in condition for allowance. Applicants therefore request that the amendment correcting the typographical error in claim 101 be entered and that all of the

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Examiner's rejections and objections be removed. Applicants further request that the Examiner allow Applicants' claims 89-108.

Respectfully submitted,



11/25/02

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Amended Version of Claim With Marking Showing Change Made

101. (Amended) A γ -alumina catalyst support having improved attrition resistance for Fischer-Tropsch hydrocarbon synthesis, said γ -alumina catalyst support being produced by a method comprising the steps, prior to adding any catalytic material to said [send] γ -alumina catalyst support, of:

- (a) calcining a boehmite material at a temperature and for a time effective to convert at least most of said boehmite material to a particulate γ -alumina support material having an average particle size of not more than 90 microns and then
- (b) treating said particulate γ -alumina support material with an acidic aqueous solution comprising water and nitric acid at a pH of not more than 5 and in an amount effective for increasing the attrition resistance of said particulate γ -alumina support material for said Fischer-Tropsch hydrocarbon synthesis and then
- (c) prior to adding any catalytic material to said particulate γ -alumina support material, recalcining said particulate γ -alumina support material at a temperature such that at least most of said particulate γ -alumina support material remains in γ -alumina form.